REMARKS

Status of the Application

Claims 24-26 are pending. The pending claims stand rejected under the doctrine of nonstatutory double-patenting, 35 U.S.C. § 102 and 35 U.S.C. § 103.

Amendments to the Specification

The specification has been amended to consolidate the related application data into a single paragraph and to correct the errors in provenance identified by the Examiner. The Applicants thank the Examiner for his helpful comments.

Amendments to the Claims

Claim 24 is being amended to eliminate the first iridium complex compound listed therein. Claim 25 is being amended to change "a charge" to "an electron" transport layer. This amendment finds support in the specification at page 18, lines 30-32. No new matter is introduced by these amendments.

Doctrine of Nonstatutory Obviousness-Type Double Patenting

Claims 24-26 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 11 of U.S. Patent No. 6,670,645 (Grushin) in view of U.S. Patent No. 6,835,469 (Kwong). Grushin and the pending application are commonly owned. Applicants hereby offer to file a terminal disclaimer under 37 C.F.R. § 1.321 (c) to remove Grushin as a reference. Kwong is neither commonly owned with the present application, nor did the inventions as claimed result from activities undertaken within the scope of a joint research agreement. With the primary reference removable with the filing of a statutory disclaimer, this rejection should be withdrawn contingent on such terminal disclaimer being filed by Applicants.

Claim Rejections – 35 U.S.C. § 102

Claims 24-26 are rejected under 35 U.S.C. § 102(e) as being anticipated by Kwong. Applicants respectfully traverse this rejection. First, Applicants submit that the claim amendments overcome this rejection. The following remarks will elucidate this further. As to claim 24, the first iridium complex composition is the only one presented in that claim that is a phenylquinoline; all others are phenylisoquinolines. Kwong discloses only the former in Fig. 2. Accordingly, Kwong does not disclose the remaining structures in claim 24, which are of a different chemical sub-genus than the first composition (quinoline vs. isoquinoline). Alternatively stated, claim 24 contains a limitation in this regard not disclosed by Kwong. This alone should nullify Kwong as an anticipating reference against this claim.

As to claim 25, the Examiner has stated that it is reasonable to interpret that a light emitting layer is also a charge transport layer. Claim 25 has been amended to limit the charge

transport of the iridium complexes to electron transport. Accordingly, the complexes are N-type semiconductor materials and can conduct electricity only by electron transport. This limitation is not disclosed, explicitly or by implication, in Kwong. Applicants respecfully submit that this rejection should be withdrawn.

As to claim 26, and referring particularly to Formulas I, II and III (Col. 2, line 50 to Col. 4, line 4), Applicants claim a compound having the Second Formula,

$$IrL^aL^bL'_yL''_z$$

wherein y = 1, z = 0, L' is not phenylquinoline, and L^a and L^b are alike or different and have a structure selected from structure (XI) [phenylquinoline] and structure (XII) [phenylisoquinoline] with R^{10} through R^{19} of structure (XI) and R^{21} through R^{30} of structure (XII) as defined. Accordingly, there must be three ligands (L^a, L^b and L') one of which cannot be phenylquinoline; the other two may be phenylquinoline or phenylisoquinoline. The ligands may vary as to their substituents. In Formulas I, II and III of Kwong, there are one, two or three ligands (n = 1, 2, or 3, see Col. 4, line 1) so that while substituents may vary, the ligands must be symmetrical, if n > 1, with respect to their backbone structures. This limitation is not present in claim 26. Kwong's Formulas IV (Col. 14, lines 1-15), V (Col. 14, lines 50-60) and VI (Col. 13, lines 1-15) also contrast with the compounds of claim 26, because n = 2 and therefore the ligands are symmetrical with respect to basic structure.

Kwong states generally in Col. 12, lines 40-52 that "compounds of the present invention" can comprise an emissive layer. In one single sentence, "In some such embodiments the emissive layer consists essentially of compounds of the present invention." These highly general statements do not enable embodiments in which compounds of the Applicants' claims comprise 20% or more of the emissive material. It is also not immediately clear to which antecedent the phrasing "such embodiments" refers. The "such embodiments" language is repeated in every single sentence of the paragraph set forth in lines 40-52, and is used in the paragraphs preceding this one throughout Col. 12. The antecedent appears to be Col. 11, line 26, which begins, "In some embodiments . . ." and then proceeds to define Formula I, a phenylquinoline, and its varioius embodiments. All of the following paragraphs pick up the "such embodiments" language, beginning with Col. 12, line 12. Apparently Col. 12, lines 42-64, refer to Formula I and its substituent definitions; this text is followed by Col. 12, line 65, "Further embodiments of the present invention . . ." in relation to Formula VI. Logically and grammatically, then, the cited text refers only to the phenylquinoline ligand complexes as they are defined in the body of text from Col. 11, line 26 through Col. 12, line 64, and not more broadly. The text associated with descriptions of other Formulas *does not* contain this language. In addition, there is only one working example of a compound of the Kwong invention in a device, Example 1, Col. 26, line 55 to Col. 27, line 14. This Example discloses the use of compounds 2-13 (all of which are depicted in Figs. 1 and 2 and are all substituted or unsubstituted symmetrical phenylquinolines) as a dopant with host material

CBP (please see Col. 26, line 65) without disclosing the host:dopant ratio. These few examples of a very limited range of compounds do not enable the Applicants' claims. Accordingly, it is respectfully submitted that Kwong does not anticipate claim 26 and that this rejection should be withdrawn.

Claim Rejections -- 35 U.S.C. § 103

Claims 24-26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over WO 01/41512 (Thompson) in view of the article by Djurovich et al., Polymer Preprints 41(1), 2000, pp. 770-771 (Djurovich). Applicants respectfully traverse this rejection for the reasons stated below.

Claims 24 and 25

Thompson discloses a general formula L_2MX. Thompson nowhere teaches or suggests substituents for either of the rings of the phenylisoquinoline structure depicted in Fig. 39. That Thompson shows one R group per ring merely suggests that substitution may be made, but does not teach or suggest what substituents would be desirable or any criteria for selecting substituents or placing them in particular points on a ring. Moreover, Thompson's depiction suggests only one substitution per ring, assuming that a particular R group is not H, in which case there would be no substitution.

Djurovich discloses only one compound, *fac*-tris[2-(4',5'-difluorophenyl)pyridine]. This is a $(ppy)_3Ir$ complex corresponding to Thompson's L_3M formulation rather than to the L_2MX formulation (which is more relevant to these claims). Thompson's specific example of L_2IrX is L = 2-phenylpyridine and X = acac (page 27, lines 1-3). Given the differences in chemistry and structure, it is difficult to see why one skilled in the art would be motivated to combine Djurovich with Thompson. As Thompson discusses in relation to the L_3M model (that which in Thompson corresponds to Djurovich's molecule) the differences between *fac* and *mer* stereochemistry (Djurovich's model has *fac* isomerism while Thompson prefers *mer*) alone produce surprising differences in the photophysics of the two structural isomers (please see Thompson at page 28, lines 7-21). Thompson goes on to say that the HOMO and LUMO energies of the two isomers vary significantly and that these differences can be expected to affect the lifetimes of OLEDs prepared with these phosphors (page 28, lines 19-21).

By combining Djurovich with Thompson, the Examiner is saying in effect that it would have been obvious to one skilled in the art to substitute fluorine atoms on the phenyl ring of Applicants' ligands based on the fluorine substitution of Djurovich's *fac*$(ppy)_3Ir$ and Thompson's L_2MX formula, using L = phenylisoquinoline and the mere suggestion that R allows for some substitution on one or more rings of the L ligand. In Djurovich, only the phenyl ring of the ppy has substituents; in Thompson, all three rings *may* be substituted, without teaching or suggestion as to what the substituent(s) might be or how electronegativity or placement on a ring might affect the luminescent properties of the compound.

Applicants submit that Djurovich's $(ppy)_3Ir$ and Thompson's L_2MX are chemically, structurally and electronically too dissimilar to motivate a skilled artisan to apply Djurovich's substituents to Thompson's L_2MX system. There are too many variables to consider and no suggestion in either reference that combining those two references would lead to the claimed compounds.

Applicants wish to respectfully restate that the fact that Thompson and Djurovich are common inventor/authors on the two references is evidence that there is no suggestion or motivation in either to combine these two particular references. Since both Thompson (international priority date of December 1999) and Djurovich (published in 2000) were aware of fluorine as a possible substituent in the world of general chemistry, if it was of interest to them, such a substituent would have been identified it if it were suitable for the "arylquinoline" ligand of Thompson. Furthermore, neither reference teaches or suggests $-CF_3$, $-OCF_3$ or $-C_8F_{17}$ substituents on any type of ligand.

Applicants respectfully restate their remarks from above, concerning the limitation in claim 25, as amended, as equally applicable herein.

Applicants respectfully request that this rejection be withdrawn with respect to Claims 24 and 25.

Claim 26

Thompson generally discloses the phenylisoquinoline backbone in Fig. 39, and generally suggests a single substituent on each ring. Nowhere does Thompson teach what these substituents might be, or whether they must all be different, or what criteria would apply to the selection of any particular substituent or group of substituents. In Thompson's formulation L L' L" M (which most closely corresponds to the Second Formula of claim 26), Thompson teaches that each ligand species is distinct (Page 12, lines 13-14). Thompson also discloses what is meant by distinct: page 12, lines 9-10, Thompson refers to Fig. 40 as exemplary of compounds where all ligands are different. In each of these, the ligand backbone is different. The ligands are not differentiated by substituents, but by the basic ligand species as set forth for ligands X in Fig. 1 and ligands L in Fig. 39. Thus, in the L L' L" M formulation, there could not be two or three "arylquinoline" ligands. The other relevant formulation in Thompson is L_3M wherein all ligand species L are the same (see page 12, line 14).

Thompson discloses a device achieving 12% quantum efficency (page 30, lines 10-19). Thompson used CBP as host and 12% by weight bis(2-benzothiazole) iridium acac as dopant in conjunction with an HTL, a BCP "blocking layer", an ETL and a Mg-Ag electrode (page 30, line 10 to page 31, line 1). This particular dopant has no chemical or structural similarity to those in claim 26. Applicants respectfully reiterate that Thompson does not teach a range of concentrations for an iridium complex in a light-emitting layer; Thompson discloses one data point: a device in which the light-emitting layer is 12% by weight BTIr in

4,4'-N,N'-dicarbazole-biphenyl. The BTIr complex does not have a ligand with Applicants' structure (XI) or (XII) as recited in Claim 26. Djurovich teaches that devices with maximum efficiency are obtained with FIrppy concentrations in the range of 2.5-3.5 wt% (*see* last paragraph on page 771). Again, the FIrppy complex does not have a ligand with Applicants' structure (XI) or (XII) as recited in Claim 26, nor does it have the ligand in the BTIr complex of Thomson. If increasing the concentration of dopant would have achieved greater quantum efficiency, it is to be assumed that Thompson would have used higher w/w concentration of the BTIr complex. There is no basis from either Thompson or Djurovich, alone or together, that emissive intensity is always directly proportional to dopant concentration.

Consequently, neither Thompson nor Djurovich alone or in combination, teach or suggest the concentration range for iridium complexes having a ligand with Applicants' structure (XI) or (XII) as recited in Claim 26. If anything, the combined references teach that the concentration of an iridium complex in a light-emitting layer should be 12 wt% *or lower*, thus teaching away from an essential limitation of Claim 26.

Applicants respectfully request that this rejection be withdrawn with respect to Claim 26.

Conclusion

In view of the foregoing amendments and remarks, Applicants submit that the above referenced pending application is in condition for allowance. A Notice of Allowance for Claims 24-26 is earnestly solicited.

This paper is accompanied by a petition to extend the time for reply by two months. The two month extension expired on Saturday, June 17, and by operation of 37 C.F.R. § 1.7 to this date, the first day thereafter which is not a Saturday, Sunday or holiday in the District of Columbia.

Respectfully submitted,

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